BENETERRA
harvesting water for beneficial use

2161 Coffeen Ave. #302 Sheridan, WY 82801
ph 307.673.0607 fax 307.673.1080 www.beneterra.com

July 18, 2006

Aaron Clark
CBM Task Force
PO Box 249
Wheatland, WY 82201

Dear Aaron:

Thank you for inviting us to participate in the hearings, July 6th, at Buffalo. As per our conversation following the hearings, I am writing to detail a few points that I did not have time to address fully in my presentation on subsurface drip irrigation (SDI).

Our business is entirely focused upon putting water to beneficial use for agriculture. We are creating a win/win solution for both energy operators and agricult ural producers, and we believe that SDI can handle significant quantities of produced waters from coalbed natural gas wells.

Potential Water Volume Handling

Energy operators face a difficult challenge in dewat ering coal seams. The volumes decline at varying rates and the initial volumes are unknown. SDI offers flexibility in water management. It is not only the most efficient method of applying water sparingly to crop land but it allows one to apply amounts that exceed crop use without causing runoff. This flexibility makes it possible for us to handle the larger volumes produced during the early life cycle of a well field yet it makes for a more sustainable supply of irrigation water in the out years.

It is essential that we grow a healthy crop to use the water applied. We have found that crops under SDI will luxuriously consume water. They appear to be using more water than predicted by conventional methods of calculation. USDA rese archers have found similar results in comparisons of SDI with surface irrigation.

The typical target annual application rate for the systems that we have designed has ranged from 45 to 60 inches per acre. However we have successfully applied more than 84 inches/acre in one year on two different soils – a sandy loam and a clay loam soil. I should note that these were dry soils that had never been irrigated. This experimental information has been useful when planning for new well fields with predicted high initial flow volumes.

We have found the application of 48 or more inches/a cre-year to be feasible in many soils. In my presentation, I used a value of 48 inches or 4 feet/acre-year for the calculation to derive the acreage needed to handle all of the coalbed produced waters in the Powder River Basin. That number was divided into, 70,500 acre-feet (1.5 Mbbl/day) to derive the result that 17,625 acres would be needed to handle the total annual production from the Powder River Basin.

As a side note, this equates to about 70,500 tons of extra hay produced in the PRB with a cash value of about six million dollars. The extra forage has a greater value than the cash figure implies because it can help ranchers keep their herds together or add to them rather than sell off as has happened during this drought. Some PRB ranchers have spent many decade s building up the genetics of their herds and that is difficult to replace once lost. The availabilit y of coal bed water may be just enough to allow some ranches to survive the drought.

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Hurdles to greater utilization of SDI

Misconceptions about water quality

One must keep in mind that the most saline CB water is 99.7% water and 0.3% salts. People continue to refer to CB water as highly saline while most of it is not even classified as saline by conventional methods. One speaker at the hearings said that there was lots of university research showing that alfalfa yields would decline if the water electrical conductivity (EC) exceeded 1,200 µS/cm. I had to leave the room at hearing his misinformed comments. One of the BeneTerra partners, who was listening to the hearings, grows high yielding dairy quality hay with EC 2,300 water from a packing plant and gets premium prices for it. Could her yields be greater with lower EC water? Possibly but I doubt it. The fact is that her yields would be non-existent without the water.

CB water is typically sodic but not saline and there are challenges associated with that. However these can be overcome through the judicious application of soil amendments and placement of drip emitters in calcareous soil.

Permitting challenges

Despite the fact that our SDI approach is focused towards beneficial use by agriculture, SDI is being treated as if we were injecting hazardous wastes. We are currently required to permit SDI systems through the Underground Injection Control (UIC VC5) program supposedly because SDI is like a septic system leach field. The language that supposedly directs the Wyoming Department of Environmental Quality (WDEQ) to require this is found on the EPA website (www.epa.gov/safe water/uic.html) states that the UIC Program is designed to protect contamination of underground sources of drinking water (USDW). It further describes Class V shallow injection wells as follows.

"Class V wells are injection wells that are not included in Classes I through IV. Class V wells inject nonhazardous fluids into or above an aquifer. They are typically shallow, on-site disposal systems, such as floor and sink drains that discharge into dry wells, septic systems, leach fields, and similar types of drainage wells."

The UIC program in Wyoming is administered by the WDEQ. Specific guidance regarding this program can be found in Chapter 16 of the Water Quality Rules and Regulations. (http://deq.state.wy.us/wqd/groundwater/uicprogram/index.asp) WDEQ has interpreted SDI to be "subsurface fluid distribution systems." Underground sources of drinking water are defined as "*aquifers or portions thereof which have a total dissolved solids content of less than 10,000 mg/L and are classified as either Class I, II, III, IV(a,) or Special (A) pursuant to Chapter 8, Quality Standards for Wyoming Groundwaters, Water Quality Rules and Regulations.*"

Coalbed water is NOT wastewater. It comes from permitted wells that are waters of the state. In our view the crux of the question that WDEQ must deal with is related to this definition. In most cases there is a serious question as to whether the groundwater beneath the fields that we intend to irrigate is a potential USDW.

The EPA defines a USDW according to Section 144.3 of 40 CFR as follows (www.epa.gov/safe water/uic/usdw.html):

Underground Sources of Drinking Water (USDW) means an aquifer or its portion: (a)(1) Which supplies any public water system, or (2) which contains sufficient quantity of groundwater to supply a public water system, and

(i) Currently supplies drinking water for human consumption , or

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(ii) Contains fewer than 10,000 mg/L total dissolved solids; and
(iii) Which is not an exempted aquifer.

WDEQ has obviously struggled with the question as to how to regulate SDI. This assumption is based upon discussions that we have had with regulators and the evolution of the regulations that we must comply with. There are some discontinuities between EPA and WDEQ in the definition of drinking *water*.

The first of which, relates to the **water volume** that can be produced by an aquifer. The EPA definition refers to an aquifer which *"contains sufficient quantity of groundwater to supply a public water system."* The WDEQ definition of an USDW does not address the quantity issue. We have discussed this with WDEQ and have not received clear guidance as to how much water an aquifer must produce before it can be considered a potential USDW. We have heard numbers from ½ to 5 gallons per minute but no guidance has been provided. Most of the groundwater investigations that we have made show that there is little groundwater quantity and the quality is not fit for human consumption.

The **water quality** limitation of 10,000 mg/L TDS as stated by both EPA and WDEQ is twenty times greater than the upper limit (500 mg/L) for domestic or drinking water as defined in Chapter 8 of the WDEQ regulations. It is twice the upper limit (5,000 mg/L) of classification for livestock consumption. So why is water of that quality even worthy of protection?

We have been asked to perform extensive groundwater surveys and place many monitoring wells in shallow aquifers that begged the questions... Why would this ever be a source of domestic water? Is this worthy of protection?

Another nuance of the UIC permitting process is that the State Historical Preservation Office has asked for a cultural resources survey on every site that we have permitted whether it is public or private land. Some of this land has been farmed for over fifty years. Will farmers need to do this in the future prior to working a piece of ground and then must they cease farming if they turn up an arrow head?

The time to permit seems to be quite slow. The first time we installed a system we did not realize that we needed to do so. Once learning that we must, we submitted an application and the permit was granted in just over 60 days. The next time we submitted an application it took about eight months. Afterwards we met with WDEQ executives, John Corra and John Wagner in Wyoming to discuss the issue.

We felt that we had made progress and they assured us that the system would be more streamlined going forward. So we submitted our third permit application and guess what – it took just over 8 months to receive the permit. Our fourth permit application was submitted January 19th of 2006 and it was finally submitted for public comment (30 days) on June 23rd. Theoretically if there are no serious objections, the permit could have been let on July 24th of 2006 – just over six months from the application date. We are awaiting that permit now. We are told that an administrator in Cheyenne now has to review all groundwater classification and we and the landowner continue to wait. In the meantime we will probably miss the fall planting season as we did this spring for another ag producer.

We have a further concern that WDEQ officials and University of Wyoming personnel feel a need to involve themselves with the effects of CB water on soils. WDEQ feels that it can regulate SDI because of their charge to protect USDW which are ultimately waters of the State.

It must be pointed out that land surface and soils do not typically belong to the state. Damages to soil are covered in agreements between the landowner, energy operator and our company. The State really has no business involving itself in those matters.

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Land availability

The BeneTerra SDI approach requires deep soils with moderate subsoil permeability and mild slopes. The soils that fit these criteria are typically terrace s along drainages or alluvial bottomland. The PRB is rough country and parcels that fit these criteria do exist and should be utilized where there is a willing landowner and an energy producer that wants to disperse water.

WDEQ has placed restrictions on the proximity of SDI systems to stream beds where some of the best land exists. For example, there are some very nice parcels along the Powder River and Clear Creek that would make great hay fields where SDI could be used well after the coalbed waters have become unavailable. Why should landowners be deprived of the benefit of subsurface irrigation because of unfounded concerns about the effect on stream water quality?

There is even a possibility that SDI placed on the alluvium could cause an increase in stream flow along losing streams by stemming losses from phreatophytes. It is well known that trees such as cottonwoods create a draw upon the stream flow . If they are left or placed between SDI systems and streambeds their demands can be supplied and the gradient decreased. The net effect would be less loss of flow and greater net stream flow.

Conclusion

In summary, we believe that subsurface drip irrigatio n can beneficially use a large portion of the produced coalbed waters in the Powder River Basin. The agricultural community will see a notable increase in available forage which in itself can stimulate other economic improvements in the lives of producers and their families. It may even save some ranchers from losing their herds.

The logistical challenges of the sodium content of the water can be dealt with effectively.

The regulatory challenges are vexing. We hope that the Task Force can exert some influence to streamline the permitting process. Permitting should be more straightforward, practical and done in a timely fashion.

I wish you the best of luck in your efforts. If you wish to reach me for further comment, my cell phone is 307.751.6805 and email is jwz@beneterra.co m.

Sincerely,

John Zupancic
Certified Professional Soil Scientist
Chief Technical Officer / Partner